

It is evident that India offers far greater advantages for investigating the variations of the solar heat than any European country can do, and as observations of the black-bulb thermometer *in vacuo* have now been registered at several stations during the last six or seven years, I have lately examined a portion of these, to see if they afford any direct evidence of a periodical graduated variation in the intensity of the radiation. The result is to me very striking, and if not absolutely conclusive as to the direct variation of the sun's heat with the number of the spots and prominences, certainly, as far as it goes, strongly confirms Mr. Baxendell's conclusions, drawn from indirect evidence.

It is unfortunate that owing to the fragility of the instruments employed and the necessity of exposing them freely, they are very frequently broken; and, as a consequence, the longest series of observations made with one and the same instrument extends over only five years. This is at Silchar in Eastern Bengal. The place is situated in lat. 25°, therefore beyond the tropic; and the climate being very damp and more cloudy than most parts of Bengal, it is not, perhaps, so favourably circumstanced for the present purpose as some other stations.

The means of the maximum sun-temperatures registered on clear days (that is, on days when the proportion of clear sky estimated at 10 A.M. and 4 P.M. did not average less than three-fifths) are given in the following table. The months of the S.W. monsoon are omitted, since in some cases they do not furnish a single clear day according to the above definition, and as a rule such days are too rare to contribute much evidence of value. I give for each month the number of clear days that have contributed to the mean.

TABLE I.—Average maximum temperature of solar radiation on clear days at Silchar.

	Days.	1870	Days.	1871	Days.	1872	Days.	1873	Days.	1874
January . .	24	124.8	25	127.1	27	122	21	121	19	121
February . .	19	130.4	20	130.9	20	125.8	19	128.2	8	128.2
March . . .	15	137.2	19	135.7	23	133.8	17	132.4	10	134.3
April . . .	12	142.6	17	139.1	13	140.5	12	134.5	5	139.8
May . . .	10	144.7	15	142.8	14	143.8	5	140.6	6	146.5
October . .	16	140.7	19	136.7	9	141.3	7	140	5	146.4
November .	23	132.2	27	126.3	15	131.7	20	127.7	10	143.1
December .	29	124.7	25	121.3	18	121.5	23	121.2	14	136.7
Year . . .	148	134.6	167	132.5	139	132.5	124	130.7	77	137

Did this table stand alone, the evidence of any periodical variation would be very doubtful. But we shall presently see that the irregularities that it exhibits are all but completely neutralised by the registers of other stations. It is easy to suggest their explanation, grounded on the fact to which all the registers testify, that the highest sun-temperatures occur, not on days registered as cloudless, but on those on which there is a considerable proportion of cloud, and frequently rain. Such days were numerous in 1874; while in 1871 (the year of sun-spot maximum) days without visible cloud predominated. Leaving the discussion of this question, however, as unnecessary in this place, I will give the combined results of Silchar and eight other Observatories variously situated, some in, and others beyond the tropical zone. These are:—

Port Blair, in the Andamans . . .	lat. 11° 41' N.
Cuttack, in Orissa . . .	" 20 29 "
Chittagong, on the Arakan coast . . .	" 21 39 "
Jessore, on the Gangetic delta . . .	" 23 9 "
Dacca, also on the delta . . .	" 23 43 "
Hazaribagh, * elev. 2,000 ft. in Western Bengal, . . .	" 24 0 "
Berhampore, * on the Gangetic delta . . .	" 24 6 "
Roorkee, elev. 900 ft. in the N.W. Prov. . .	" 29 52 "

Since the radiation-thermometers originally in use at

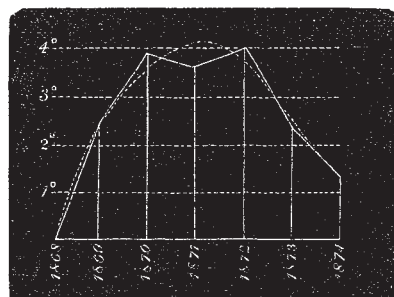
* The registers of these two stations taken alone give a curve nearly approximating to the resultant of all the stations, but it is of doubtful validity owing to the thermometers having been twice renewed at both stations.

most of these stations have been broken and replaced by other instruments, and since these thermometers (furnished by the best London makers) sometimes differ to the extent of many degrees when placed under the same conditions of exposure, it would be only misleading to compare together the registers of different years recorded with different instruments at the same station. In order to avoid this source of error, and at the same time to bring in evidence as much as possible of the registers, I have taken for each station separately the difference (rise or fall indicated respectively by + and -) of each pair of homonymous months in consecutive years, omitting all cases in which the instrument has been changed in the interval; and then the mean of all the differences thus obtained for the same pair of months. The results are given in the following table, additional columns being added to show how many stations have contributed to the mean of each pair of months. As in Table I, the mean temperatures compared are those of clear days only; but with the exception of Port Blair, I have admitted as clear days those only on which at least four-fifths of the sky on an average was estimated as unclouded at 10 A.M. and 4 P.M. In the case of Port Blair it was necessary to admit days with only one half of unclouded sky.*

TABLE II.—Annual variation of mean maximum readings of black-bulb thermometers on clear days.

	Station.	1868 1869	Station.	1869 1870	Station.	1870 1871	Station.	1871 1872	Station.	1872 1873	Station.	1873 1874
January . .	2	- 0.9	3	+ 0.5	4	+ 0.4	6	- 3.7	4	+ 0.4	8	- 5.3
February . .	2	+ 1.9	3	+ 1.5	4	+ 0.6	6	- 3.6	4	+ 2.1	8	- 3.6
March . . .	2	+ 3.8	3	+ 1.2	4	+ 2.6	6	- 2.4	5	- 0.7	8	- 1.7
April . . .	2	+ 7.1	3	+ 1.5	7	- 0.5	5	+ 0.7	6	- 0.7	8	- 2.5
May . . .	1	+ 14.2	3	+ 0.9	7	- 1.9	4	+ 2.6	7	- 4.7	8	+ 2.7
October . .	2	- 4.3	3	+ 8.2	6	- 1.5	4	+ 0.6	4	+ 3.5	8	- 3.6
November .	3	- 2.7	4	+ 0.4	6	- 1.3	4	+ 2.2	8	- 2.9	8	+ 0.8
December .	3	- 1.0	4	+ 1.8	6	- 0.3	4	+ 0.4	-	- 1.6	-	- 1.1
Year . .		+ 2.3		+ 1.6		- 0.3		+ 0.4		- 1.6		- 1.1

If these differences be plotted as the increments of a series of ordinates, and the curve thus marked out be corrected for its small irregularities *libera manu*, its resemblance in general character to the sun-spot curve will be distinctly apparent. (See figure.)



I have been unable to ascertain (here in Calcutta) the number of spots observed during the last few years; but this datum can readily be supplied at home.

Calcutta, May 28

HENRY F. BLANFORD

LECTURES AT THE ZOOLOGICAL GARDENS†

VIII.

Mr. Sclater on the Pheasants.

IN that Birds possess a high temperature of the blood, they agree more with the mammalian than with other vertebrate animals; the balance of anatomical evidence

* I have ascertained by direct comparison that any difference thus introduced is inappreciable, the results being treated comparatively, and not for absolute values.

† Continued from p. 129.

is, however, in favour of their more intimate reptilian affinities. They are characterised externally by their covering of feathers, and by the fore limbs being developed to form wings. These wings, though primarily constructed for flight, in some birds perform other functions. In the Penguins they are employed for swimming, in the Ostrich to assist in running, whilst in the Apteryx and the Cassowary their condition is so rudimentary that they can be of no service to their owners. In the Night Parrot and the Weka Rails the wings are very much diminished.

Birds are divided into from seventeen to twenty well-marked groups, of which the Gallinæ, the order which contains the Pheasants, forms one which is more important in an economical point of view than any of the others, as it contains most of the domesticated species of birds, the ducks and pigeons being exceptions. The Game Birds, as the Gallinæ are commonly termed, may be divided into the following seven sections:—1. The *Pteroclidæ*, or Sand Grouse, birds which inhabit Africa and Western Asia. By some naturalists they are grouped with the Pigeons; they, however, differ from them and agree with the fowls in laying coloured eggs, at the same time that the young ones run about directly they are hatched. There is one species, found in the steppes of Tartary, in which, unlike its allies, the hind toe is absent. In the year 1863 a flock of Sand Grouse spread over all Western Europe. Prof. Newton tell us, in the "Ibis," that not less than seven hundred individuals must have appeared. A few stragglers were seen for a short time afterwards. 2. The *Meleagridæ*, or Turkeys, are unfortunately so called, as they are in their wild state confined to Northern and Central America. Only three wild species are known, the most northern of which is said to be the parent stock of our domesticated form, although some of the evidence is in favour of the latter having sprung from the Mexican species. The Ocellated Turkey, from Honduras, is a particularly handsome bird. 3. The *Numididæ*, or Guinea Fowl, are represented in Guinea by one species. The four or five others are all confined to Africa; of these, the elegant Vulturine Guinea Fowl, of which several specimens have been presented to the Zoological Gardens by Dr. Kirk, comes from Zanzibar. 4. The *Cracidæ*, or Curassows, are the representatives of the Game Birds in Central and South America. They will not nest in captivity here, perhaps because, as they are arboreal in their habits, it is not possible to give them suitable abodes. They are said to have been first introduced into Europe by the Dutch, from the island of Curassow, in the West Indies. In some species the cock and hen are identical in plumage; in others very dissimilar. 5. The *Megapodidæ*, or Megapodes, are confined almost entirely to the Australian region. They are nearly allied to the Cracidæ. Their eggs are laid in the middle of a mound composed of earth and grass, where they are left to be hatched. Many eggs are laid, and the young ones are able to fly within twenty-four hours of leaving the egg. Their breeding habits have been well described by Mr. Bartlett, from examples which have laid in the Society's Gardens. By one species the mound constructed is as much as 15 ft. high and 60 ft. in circumference. The habits of one peculiar species, the Maleo of Northern Celebes, have been well described by Mr. Wallace. 6. The *Turnicidæ*, or Hemipodes, much resemble quails. They are mostly African, one species occurring in Andalusia. Their anatomy is somewhat peculiar. 7. The *Phasianidæ*, or Pheasants, are constituted by (a) the *Tetraonidæ*, or Grouse, inhabitants of the mountainous regions of Europe and Northern Asia. In all the species the legs, and in some the toes, are feathered. They do badly in captivity. The best known of them are the Prairie Fowl, Capercaillie, Black-cock, and Ptarmigan. (b) The *Perdicidæ*, or Partridges, are found in every part of the Old World. The Snow Pheasant of the Himalayas is one of the

largest species. The Impeyan Pheasant, from the same locality, is a closely allied form. These birds are represented in America by (c) the *Odontophoridæ*, or Colins, sometimes called toothed Partridges, because the bill is slightly toothed. They are much more arboreal than their Old World representatives, and none of them attain a great size. (d) The *Phasianidæ*, or Pheasants proper, form about forty species, arranged in seven genera. The story runs that the common Pheasant was first brought from Colchis by the Argonaut, whence its scientific name, *P. colchicus*. The genera include the *Crossoptilon*, or Eared Pheasants of Northern Asia, of which there are four species: the true Pheasant, preserved in this country; the *Thaumalea*, or Gold Pheasant, with its superb ally, the Amherst Pheasant of Central Asia, first made known from a specimen brought over by the Lady Amherst when returning from an embassy to the King of Ava. Further facts respecting its distribution have been obtained by Dr. John Anderson and Mr. Stone. The *Euplocami*, or Kaleeges, are represented by twelve species. They are intermediate between the Pheasants and the Fowls. A new species has been quite recently obtained by Mr. Gould from the interior of Borneo (*Lobiophasis*). *Gallus* is the name given to the genus which includes the Fowls, of which there are four species. The Jungle Cock of India is the wild ancestor of the domesticated bird; others are inhabitants of Ceylon and Java. *Ceriornis* includes the Tragopans, which are peculiar in having horned appendages to the head. There are five species in this beautiful group. (e) The *Pavonidæ*, or Peafowls, are natives of the forest jungles of India, and such being the case it is strange that they so well resist the winters of our own country. *Polyplectron*, or the Peacock Pheasant, is an allied form; it is aberrant, however, in that it is monogamous and lays only two eggs. The Argus Pheasant also belongs to the same family.

THE PROGRESS OF THE TELEGRAPH *

VIII.

MORE daring inventors, as we have seen, entered the field—Nott and Gamble, with a letter-showing telegraph; Edward and Henry Highton, who produced an array of signal apparatus, in some cases evading the Cooke and Wheatstone patents by the use of nickel for the electromagnet in place of soft iron. But formidable beyond all other competitors was the talented Alexander Bain, the Edinburgh watchmaker, who has contributed largely to the improvement of the telegraph by his singularly beautiful adaptations and chemical printing arrangements. Expensive litigation speedily followed, and the directors in most cases compounded with their opponents. Alexander Bain was made a director of the Company, and at the same time received 12,000*l.* for his chemical printer, and most of the other opposing patents became the property of the Company by special arrangements with the inventors. By means such as these a monopoly for a time was secured, even though it was purchased at an exorbitant price. Monopoly at that time represented commercial gain, and every aspiring inventor was sooner or later run off his feet by the powerful and wealthy corporation. Such is the early history of the introduction and opening of the Electric Telegraph as a means of the transmission of inland intelligence. The telegraphic connection of Great Britain with the Continent of Europe at this time was scarcely developed, the extent of electrical communication by the continental land lines being circumscribed.

This, however, thanks to further applications of science, is no longer the case. The planet is now girt by telegraphs. First, there is the "Great Northern,"

* Continued from p. 113.